



Intraoperative Neuromonitoring
Functional Neurosurgery
Pain Treatment
Neurological Diagnostics

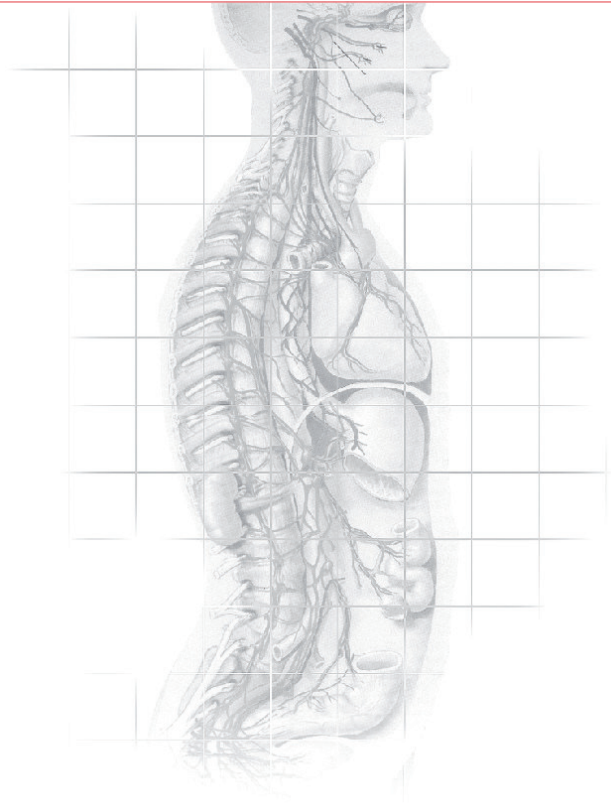
RF Pain Treatment

»» **LG2**

New Lesion Generator 2 Channel



- › *Overview of RF Pain Treatment*
- › *Methodology*
- › *RF Thermoablation with LG2*



The treatment of pain – chronic pain in particular – is always a therapeutic challenge.

Complex physiological processes as well as individual variations in patients require a high level of professional competence, experience and, usually, comprehensive multidisciplinary therapeutic approaches for successful treatment.

Overview of RF Pain Treatment

RF Pain Treatment

RF Pain Therapy

RF Thermoablation

inomed supports your therapeutic concept with technically advanced systems and comprehensive auxiliary equipment for interventional & minimally invasive pain therapy.

RF Pain Treatment

Persisting pains inherently already are a great burden and frequently trigger a series of secondary reactions such as muscle tensing, shortening and hardness. Patients adopt compensatory positions and thus strain originally healthy structures.

This is the beginning of a vicious circle that has to be broken.

After precise diagnosis and the identification of indications, a wide range of therapeutic options are available to the therapist. The majority of patients can be helped with non-invasive therapies, frequently in combination.

In a large patient group, these methods unfortunately do not lead to lasting therapeutic success. In these cases, only interventional pain treatment provides lasting relief.

Once the pain is interrupted, this in itself may already lead to pain relief or physiotherapy or medication treatment can now be used effectively.

RF Pain Therapy – interventional/minimally invasive

Interventional pain treatment takes advantage of minimally invasive procedures with the aim of lasting pain relief through selective interruption or modification of the pain signal conduction along the affected nerve pathways. This is either achieved by targeted injection of medication or by the interruption of the pain signal conduction through neuro-destructive procedures. For this, percutaneous, minimally invasive procedures are the best choice.

Under visual control and electrical stimulation monitoring, specifically directed electrodes, probes or catheters are generally inserted through tubes depending on the method:

- for application of cold onto peripheral nerves – cryoablation
- for thermal lesion of nervous tissue – radiofrequency thermal lesion
- for application of chemical substances

The nerve areas responsible for motor function are not affected!

Overview of RF Pain Treatment

“Elimination or at least considerable reduction of the pain gives the body the chance to recover or even to heal by itself.”

RF Thermoablation

With correct identification of the indication, radiofrequency thermal lesion is an extremely precise, effective and safe method with many fields of application to combat chronic pain.

Since it can be carried out at the outpatient clinic under local anaesthetic, it is not very stressful for the patient.

The thermal action of a high-frequency current of about 300 kHz – 5 MHz has already been used for decades in high-frequency surgery for cutting and tissue ablation during surgical procedures. High-frequency current causes an electrolyte shift. This ion movement causes a marked development of heat in the tissue close to the electrode.

At temperatures of 60 – 90 °C, this is known as thermal coagulation which enables functional elimination of the pain fibres.

Percutaneous procedures for pain treatment require precise control of the coagulation effect. The aim is an irreversible coagulation as effective as possible over the desired area. This is made possible by measuring and monitoring all coagulation parameters such as voltage, current, impedance, temperature evolution and time of application. The probe diameter and length of the active tip have an influence on the lesion.

Modern RF devices for percutaneous pain treatment procedures generally use digital temperature regulation (a micro-thermal element is integrated in the electrode tip) which, on the one hand, can be adjusted to the electrode and, on the other, enables the generation of defined temperature-time curves.

Procedure

- X-ray-guided positioning of the cannula / electrode under local anaesthetic
- identification of the target point with direct nerve stimulation
- temperature or temperature profile mode for RF thermoablation

Here, too, the principle applies that only the elimination of the primary pain first makes other useful therapeutic measures possible.

Cannulas / Probes

A major advantage of the radiofrequency thermoablation is the opportunity to be able to perform high-precision procedures with very delicate instruments. The instrument dimensions are determined by the indication and the target area.

inomed offers users a broad range of the most diverse electrodes and cannula systems.

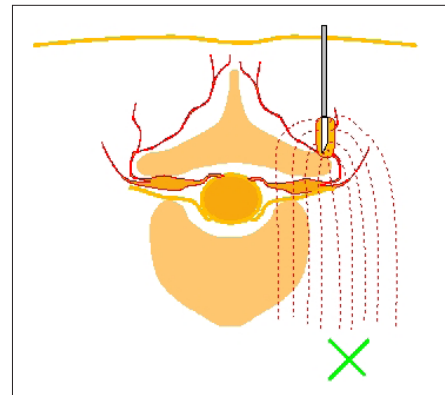
Application of RF-Thermoablation

- degenerative back pain
- chronic pain of the axial skeleton
- non-surgical cervical and lumbar intervertebral disc pain
- non-surgical nerve root (radicular) compressions
- Herpes Zoster
- chronic pain syndromes of the sympathetic nervous system, e.g., sympathetic algodystrophy
- cervicobrachialgia / cervicoccephalgia, e.g., after whiplash or of degenerative origin
- cluster headaches
- trigeminal neuralgia
- chronic tumour pain

Methodology

General Procedure

Treatment Examples



Surface area with abdominal electrode placement

1. General Procedure

The identification of the correct target area during RF Thermolesion depends on the specific application fields. Therefore inomed offers particular workshops for training on specific RF techniques.

1.1. Diagnostics

A test blockade by injection of a local anaesthetic with x-ray CT control monitoring must confirm that the nerve „identified“ in the pain anamnesis and thorough physical examinations is actually responsible for the pain.

1.2. Treatment

Localisation of target area

- with x-ray or CT monitoring, the cannula / electrode is advanced into the target area.

Localisation of target point by electrical stimulation

- electrophysiological position monitoring through electrical stimulation via probes, electrodes / cannulas
- the required stimulation intensity is an approximate measure for the electrode / nerve distance
 - 0.1 mA ~ 0.5 mm
 - 1 mA ~ 2 mm

The correct placement of the neutral surface electrodes using monopolar electrodes is important, because the current flow of the RF Thermolesion depends on it. For facet denervation an abdominal electrode placement is recommended.

After positioning and bone contact

- motor stimulation check: 2 Hz, 3 – 5 mA or 3 – 5 V to avoid any motor nerve branch impairment
- sensory stimulation: 50 Hz, tingling of the painful area, otherwise re-positioning

Parameters for adjustment of electrical stimulation

Direct nerve stimulation: 0 – max. 10 mA or 0 – max. 10 V
(impedance 1 kOhm, 1 mA = 1 V)

Sensory stimulation: 50 – 100 Hz,
pulse width 100 – 200 µsec

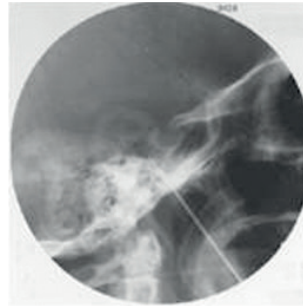
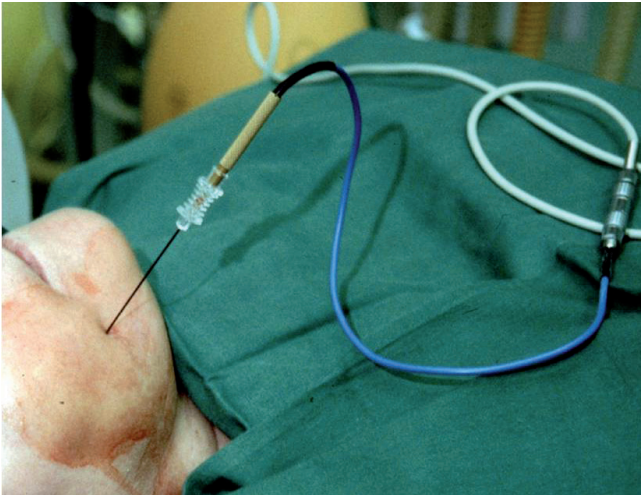
Motor stimulation: 2 – 5 Hz,
pulse width 100 – 200 µsec

Lesion

According to indication and method

- radiofrequency thermal lesion
- pulsed radiofrequency treatment

Methodology



RF thermolesion on the example of trigeminal neuralgia
Trigeminal ganglion (Gasserian ganglion), after Tronnier, Lübeck, Germany

2. Treatment Examples

2.1 RF Thermal Lesion on the Example of Trigeminal Neuralgia

Teststimulation

- before lesion: sensory stimulation 50 Hz, 0.1 – 0.4 V
- impedance measurement and motor stimulation not necessary
- below 0.4 volt, the pain should be reproducible
- X-ray monitoring and documentation

Lesion

- short-acting anaesthetic
- select temperature 70 – 75 °C, depending on pre-existing hypaesthesia
- common RF lesion duration 60 – 90 sec
- when patient is awake, neurological check by stimulation - now pain should not appear before level 1.0 V
- possibly second, more peripheral lesion without anaesthetic since pain conduction remains blocked
- X-ray monitoring and documentation

2.2 Example: Pulsed RF Therapy

This form of radiofrequency therapy differs from conventional radiofrequency treatment by the following characteristics:

- energy transmitted in short pulses instead of continuously in order to remain below tissue-coagulation heat (max. 42 °C)
- treatment is less painful for the patient
- nerves recover by activated self-healing power

Works of **M. Sluiter** demonstrate beneficial and consistent results when applying following recommended settings:

Voltage:	40 – 60 V
Frequency:	2 Hz
Pulse duration:	approx. 20 msec
Duration of treatments:	3 to 10 minutes

RF Thermolesion with LG2

LG2 Lesion Generator
Art. no. 262 000



Radiofrequency Thermal Lesion with the LG2

The LG2 is a universal device for all common lesion applications in pain treatment and functional neurosurgery and meets the most exacting requirements in terms of safety, precision and comfort of use.

A large variety of instruments and devices are adaptable to the LG2. The LG2 device includes two independent RF channels, which can be used at the same time. It supports mono- or bipolar electrodes. The combination of two monopolar electrodes for a bipolar application is possible.

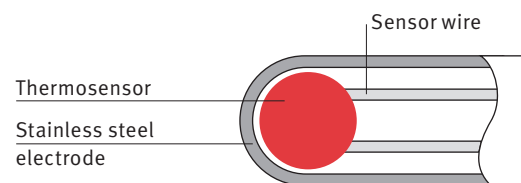
LG2-Features

- Continuous RF in two different modes:
Temperature or Preset Temperature-Profile
- Pulsed RF in three different modes:
Temperature, Voltage, RF-Duration
- Direct Nerve Stimulation for the localisation of motoric and sensoric nerves
- Continuous Impedance-measurement
- Continuous Temperature-measurement
- Touchscreen Display
- Graphic display of temperature-gradient
- Digital display of all relevant application-parameters
- Up to 30 preset parameters memorized
- Remote control

Accessories

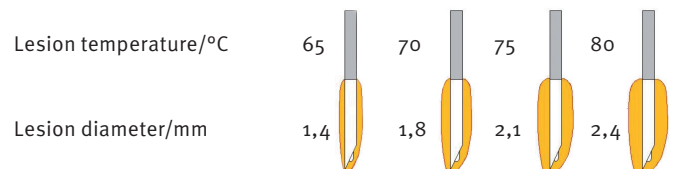
Depending on the application, a large variety of instruments are adaptable to the LG2 for temperature-controlled RF lesions in neurosurgery and for pain therapy. Temperature-controlled (TC) pain electrodes and the corresponding insulated RF cannulas are commonly used. These are connected to the lesion generator together with the temperature-controlled (TC) electrodes.

Due to the insulation coating on the cannula shaft, only the exposed (non-insulated) tip of the cannula is conductive and can be used for impedance measurements, for stimulation and RF thermocoagulation. A temperature sensor in the tip of the electrode provides temperature-controlled high-frequency heating.



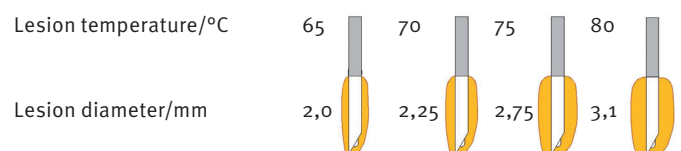
Lesion range with 22-gauge cannulas at various temperatures

Active tip 5 mm



Lesion range with 20-gauge cannulas at various temperatures

Active tip 5 mm



Technical specification for LG2

Impedance Unit

Measuring Range	30 Ω - 2 k Ω	Resolution:	1 Ω	30 Ω - 1 k Ω
			100 Ω	1 k Ω - 2 k Ω

Direct Nerve Stimulation

Motoric Stimulation Frequency	1 Hz - 49 Hz	Resolution:	1 Hz
Sensory Stimulation Frequency	50 Hz - 200 Hz	Resolution:	1 Hz
Pulse Duration	50 μ s - 3 ms	Min. Resolution:	50 μ s
Voltage Range	50 mV - 10 V	Min. Resolution:	50 mV
Current Range	50 μ A - 8 mA	Min. Resolution:	50 μ A
Auto Ramp	rising edge steps 0.5s/1s/2s	Min. Resolution:	50 mV [50 mV - 10 V] 50 μ A [50 μ A - 8 mA]
Waveform	unipolar - square wave		
Neutral Split Electrode Contact Monitor ...	CQM (Contact Quality Monitoring), Colour bar: green- yellow -red		

Continuous RF

RF Control Mode	Temperature, Preset Temperature Profile		
Lesion Temperatur	30 $^{\circ}$ C - 95 $^{\circ}$ C	Resolution:	1 $^{\circ}$ C
Lesion Time	0 - 10 min	Resolution:	10 sec
Monitored Temperature Accuracy	\pm 2 $^{\circ}$ C		
Monitored Temperature Range	20 $^{\circ}$ C - 105 $^{\circ}$ C		
Frequency	488 kHz	Sinewave	
Load Impedance Range	50 Ω - 2 k Ω		
Max. Output Voltage	100 Vrms		
Max. Output Current	800 mA		
Max. Nominal RF Output Power	50 W per Channel, if one Channel is active 50 W split into 2 Channel, if Ch1 + Ch2 are active		
Stagger Time Ch1 -Ch2	0 - 120 sec	Resolution:	1 sec

Pulsed RF

RF Control Mode	Voltage, Pulse Duration, Temperature		
Voltage	20 V - 70 V	Resolution:	1 V
Pulse Duration	3 ms - 40 ms	Resolution:	1 ms
Temperature	30 $^{\circ}$ C - 95 $^{\circ}$ C	Resolution:	1 $^{\circ}$ C
Lesion Time	30 sec - 30 min	Resolution:	30 sec
Frequency	1 Hz - 10 Hz	Resolution:	1 Hz

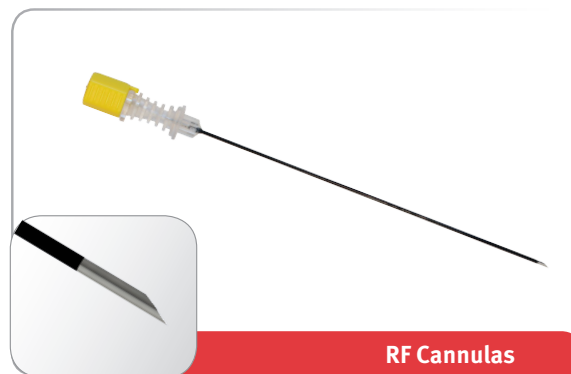
Accessories for LG2

Electrodes and Fitting Cannulas for LG2

Electrodes with 4-pole SuperLight Connector



SuperLight Connector



RF Cannulas

Art. no. Electrodes

260 006	TC pain electrode 50 mm for disposable cannula with 50 mm working length <ul style="list-style-type: none"> delivered non sterile autoclavable
260 011	TC pain electrode 100 mm for disposable cannula with 100 mm working length <ul style="list-style-type: none"> delivered non sterile autoclavable
260 016	TC pain electrode 150 mm for disposable cannula with 150 mm working length <ul style="list-style-type: none"> delivered non sterile autoclavable
260 121	TC trigeminus electrode for disposable cannula with 115 mm working length <ul style="list-style-type: none"> delivered non sterile autoclavable

Art. no. Cannulas (10 pcs)

240 100	Disposable cannula 22Gx50x4 isolated with mandrin
240 109	Disposable cannula 22Gx50x7 isolated with mandrin
240 101	Disposable cannula 22G x 100 x 2, isolated with mandrin
240 102	Disposable cannula 22G x 100 x 5, isolated with mandrin
240 114	Disposable cannula 22G x 100 x 7, isolated with mandrin
240 106	Disposable cannula 22G x 100 x 10, isolated with mandrin
240 152	Disposable cannula 22G x 100 x 5, curved, isolated with mandrin
240 153	Disposable cannula 22G x 100 x 10, curved, isolated with mandrin
240 156	Disposable cannula 22G x 100 x 10, curved, sharp tip, isolated with mandrin
240 157	Disposable cannula 22G x 100 x 10, curved, blunt tip, isolated with mandrin
240 111	Disposable cannula 20G x 100 x 2, isolated with mandrin
240 110	Disposable cannula 20G x 100 x 5, isolated with mandrin
240 120	Disposable cannula 17G x 100 x 2, isolated with mandrin
240 121	Disposable cannula 17G x 100 x 5, isolated with mandrin
240 122	Disposable cannula 17G x 100 x 7, isolated with mandrin
240 123	Disposable cannula 17G x 100 x 10, isolated with mandrin
240 103	Disposable cannula 20G x 150 x 2, isolated with mandrin
240 104	Disposable cannula 20G x 150 x 5, isolated with mandrin
240 105	Disposable cannula 20G x 150 x 7, isolated with mandrin
240 107	Disposable cannula 20G x 150 x 15, isolated with mandrin
240 108	Disposable cannula 20G x 150 x 10, isolated with mandrin
240 154	Disposable cannula 20G x 150 x 5, curved, isolated with mandrin
240 155	Disposable cannula 20G x 150 x 10, curved, isolated with mandrin
240 158	Disposable cannula 20G x 150 x 10, curved, sharp tip, isolated with mandrin
240 159	Disposable cannula 20G x 150 x 10, curved, blunt tip, isolated with mandrin
240 140	Disposable cannula 18G x 115 x 2, isolated with mandrin
240 141	Disposable cannula 18G x 115 x 5, isolated with mandrin
240 133	Disposable cannula 18G x 115 x 5, isolated with mandrin for Neurotherm
240 142	Disposable cannula 18G x 115 x 7, isolated with mandrin
240 143	Disposable cannula 18G x 115 x 10, isolated with mandrin

Connecting Cable for LG2

Art. no. Connecting Cable

262 004	TC cable SuperLight TC cable 3 m for LG2 with 6-pole Redel connector for TC electrodes with 4-pole SuperLight connector <ul style="list-style-type: none"> delivered non sterile autoclavable
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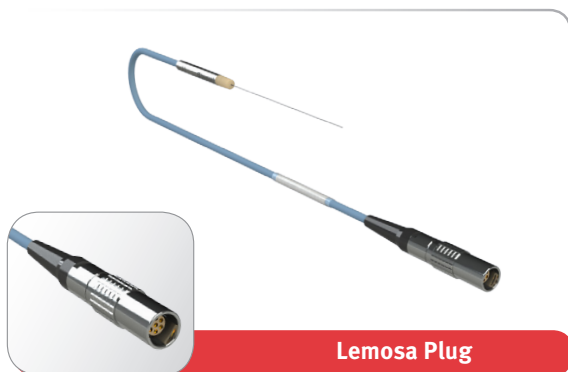
Conversion table for cannulas » Gauge - mm

Gauge	22 G	20 G	18 G	17 G
mm	0,7	0,9	1,2	1,4

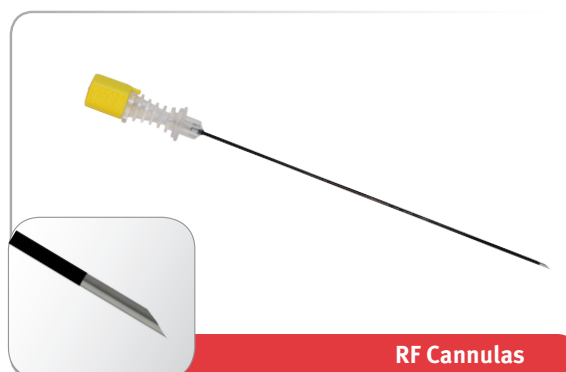
Accessories for LG2

Electrodes and Fitting Cannulas for LG2

Electrodes with 7-pole Lemosa Plug



Lemosa Plug



RF Cannulas

Art. no. Electrodes

- 260 005** TC pain electrode 50 mm for disposable cannulas with 50 mm working length
- delivered non sterile
 - autoclavable
- 260 010** TC pain electrode 100 mm for disposable cannulas with 100 mm working length
- delivered non sterile
 - autoclavable

- 260 015** TC pain electrode 150 mm for disposable cannulas with 150 mm working length
- delivered non sterile
 - autoclavable

- 260 126** TC trigeminus electrode for disposable cannulas with 115 mm working length
- delivered non sterile
 - autoclavable

Art. no. Cannulas (10 pcs)

- 240 100** Disposable cannula 22G x 50 x 4, isolated with mandrin
- 240 109** Disposable cannula 22G x 50 x 7, isolated with mandrin
- 240 101** Disposable cannula 22G x 100 x 2, isolated with mandrin
- 240 102** Disposable cannula 22G x 100 x 5, isolated with mandrin
- 240 114** Disposable cannula 22G x 100 x 7, isolated with mandrin
- 240 106** Disposable cannula 22G x 100 x 10, isolated with mandrin
- 240 152** Disposable cannula 22G x 100 x 5, curved, isolated with mandrin
- 240 153** Disposable cannula 22G x 100 x 10, curved, isolated with mandrin
- 240 156** Disposable cannula 22G x 100 x 10, curved, sharp tip, isolated with mandrin
- 240 157** Disposable cannula 22G x 100 x 10, curved, blunt tip, isolated with mandrin
- 240 111** Disposable cannula 20G x 100 x 2, isolated with mandrin
- 240 110** Disposable cannula 20G x 100 x 5, isolated with mandrin
- 240 120** Disposable cannula 17G x 100 x 2, isolated with mandrin
- 240 121** Disposable cannula 17G x 100 x 5, isolated with mandrin
- 240 122** Disposable cannula 17G x 100 x 7, isolated with mandrin
- 240 123** Disposable cannula 17G x 100 x 10, isolated with mandrin
- 240 103** Disposable cannula 20G x 150 x 2, isolated with mandrin
- 240 104** Disposable cannula 20G x 150 x 5, isolated with mandrin
- 240 105** Disposable cannula 20G x 150 x 7, isolated with mandrin
- 240 107** Disposable cannula 20G x 150 x 15, isolated with mandrin
- 240 108** Disposable cannula 20G x 150 x 10, isolated with mandrin
- 240 154** Disposable cannula 20G x 150 x 5, curved, isolated with mandrin
- 240 155** Disposable cannula 20G x 150 x 10, curved, isolated with mandrin
- 240 158** Disposable cannula 20G x 150 x 10, curved, sharp tip, isolated with mandrin
- 240 159** Disposable cannula 20G x 150 x 10, curved, blunt tip, isolated with mandrin
- 240 140** Disposable cannula 18G x 115 x 2, isolated with mandrin
- 240 141** Disposable cannula 18G x 115 x 5, isolated with mandrin
- 240 133** Disposable cannula 18G x 115 x 5, isolated with mandrin for Neurotherm
- 240 142** Disposable cannula 18G x 115 x 7, isolated with mandrin
- 240 143** Disposable cannula 18G x 115 x 10, isolated with mandrin

Connecting Cable for LG2

Art. no. Connecting Cable

- 262 007** TC cable Lemosa
TC cable 3 m for LG2 with 6-pole Redel connector for TC electrodes with 7-pole Lemosa connector
- delivered non sterile
 - autoclavable

Conversion table for cannulas » Gauge - mm

Gauge	22 G	20 G	18 G	17 G
mm	0,7	0,9	1,2	1,4

Accessories for LG2

Neutral Surface Electrode for LG2

Art. no. **Neutral Surface Electrode****211 009** **Neutral surface electrode**

adhesive for monopolar stimulation and coagulation applications

- Single use

262 012 **Neutral surface split electrode**

adhesive for monopolar stimulation and coagulation applications, contact impedance is permanently checked by LG2

- Single use

262 002 **Neutral cable**

Cable 3 m for LG2 with 2-pole connector and clip flat male connector for neutral surface electrodes (art. no. 211 009)

- non-autoclavable
-

Additional Accessories for LG2

Art. no. **Remote Control****262 001** Remote control

Cable 2,5 m for LG2 with Redel connector grey 4-pole, including 4 keys to control the LG2

- non-autoclavable
-

Termination connector**262 003** Connector to terminate RF channels during selftest

Contact

First name, surname

Hospital

Department

Street, No.

Postal area code,
locality

Telephone Fax

E-mail

Art. No.	Qty.	Description	Quote request	Order placement
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Development

Our products are the result of decades of experience in clinical tests and secure trials. This formula for success ensures that your patients receive the best possible treatment.

Quality management

Our work is driven by the very essence of medicine: helping people. This makes for high quality, reliable products – a standard that we strive to safeguard and maintain every single day.

Technical support

The use of our systems very much depends on smooth functioning and skilled operation. Our support team provides reliable, knowledgeable answers to all your technical questions as well as a straightforward on-site service.

System finder

When it comes to choosing new systems, we can help you select the equipment which best suits your needs. This saves you valuable time and offers you maximum reliability right from the start both in terms of planning and cost.

Hotline

We are there for you whenever you need us. Our fast, reliable service provides you with solutions either via telephone or directly on site.

Training events

Our regular training courses for surgeons, medical assistants and operating theatre staff keep you up to date with the latest research. Naturally, our training services also include detailed on-site training and system start-up.

Preventive maintenance

Regular servicing, inspections and software updates are indispensable requirements for smooth operating room processes. They ensure that your equipment is always kept up to date and offers the highest level of functional safety.

Individual solutions

We would be delighted to advise you – not just about our systems, but also about going beyond them. Our in-house production allows us work together with our clients to create tailored solutions for specific applications.

Hitting the Nerve

inomed is a medical technology company, operating internationally, which develops nerve protection instruments and systems for precisely targeted patient treatment.

Sharing Knowledge

Working with doctors and users, inomed develops new tools and methods in the fields of intraoperative neuromonitoring, neurosurgery, pain therapy and neurological diagnostics.

Providing Safety

inomed improves treatment outcomes with high-quality products and uses innovative technologies to ensure safety for both treatment providers and patients.



Our Product Portfolio

Our broad range of products is divided into four core areas. In close collaboration with customers, we continually translate new ideas into tools and develop new methods for the patients' benefit. Find an overview about the variety of competencies on the internet.

Worldwide Support via Licensing Partners

We are an internationally operating company. In many countries, our clients can count on specialised staff closely associated with inomed. We also invest heavily in training and workshops for our partners and distributors. You will find inomed's support and benefit from all advantages – anywhere you are!

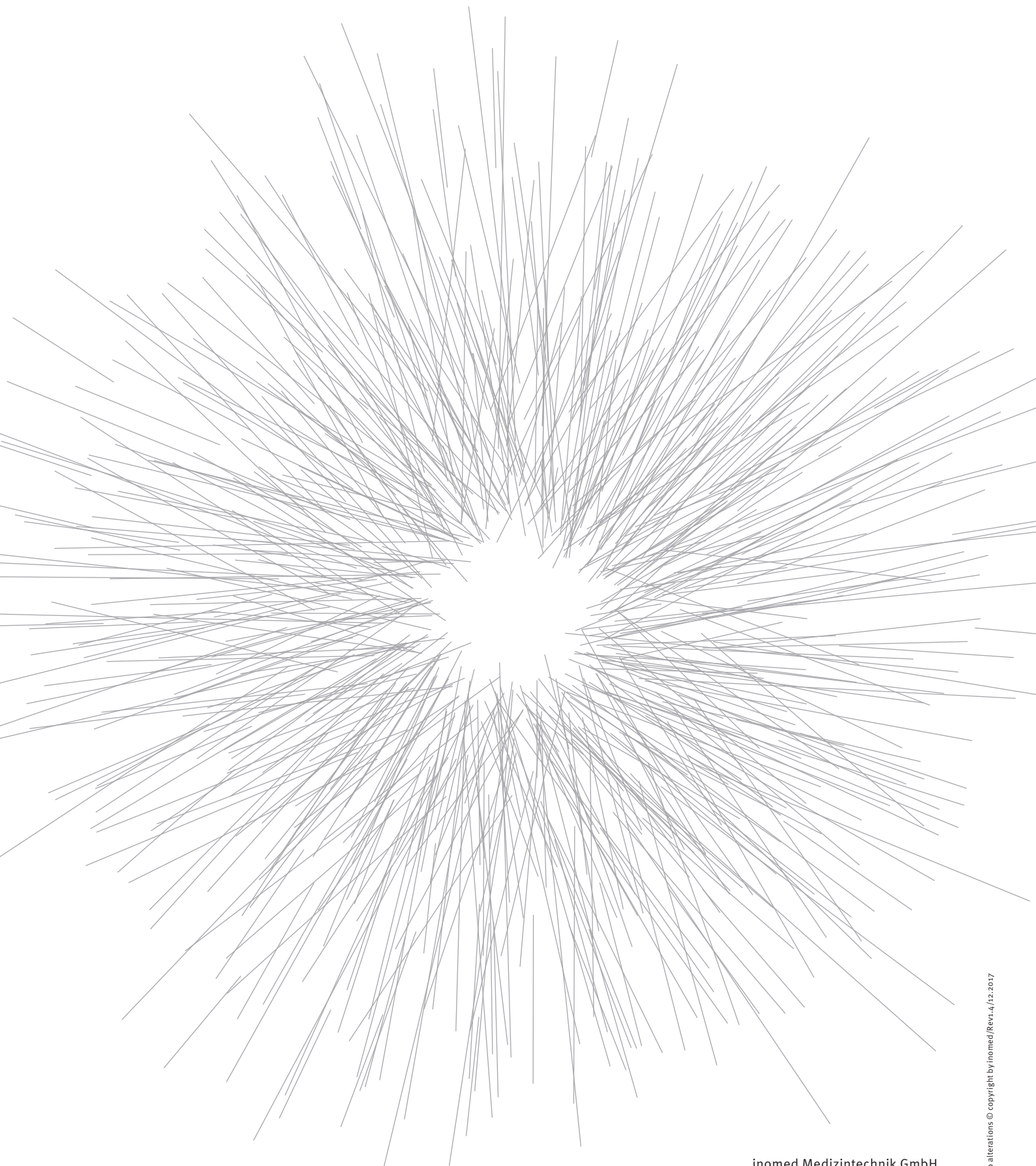
For further information, please visit our website:

www.inomed.com



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